

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference FP21082	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/AU2005/000088	International filing date (<i>day/month/year</i>) 28 January 2005	Priority date (<i>day/month/year</i>) 28 January 2004
International Patent Classification (IPC) or national classification and IPC Int. Cl. C22B 3/40 (2006.01) C22B 23/00 (2006.01)		
Applicant COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION et al		

- This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 3 sheets, including this cover sheet.
- This report is also accompanied by ANNEXES, comprising:
 - ☒ (*sent to the applicant and to the International Bureau*) a total of 5 sheets, as follows:
 - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - ☐ (*sent to the International Bureau only*) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or table related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
- This report contains indications relating to the following items:

<input checked="" type="checkbox"/> Box No. I	Basis of the report
<input type="checkbox"/> Box No. II	Priority
<input type="checkbox"/> Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input type="checkbox"/> Box No. IV	Lack of unity of invention
<input checked="" type="checkbox"/> Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/> Box No. VI	Certain documents cited
<input type="checkbox"/> Box No. VII	Certain defects in the international application
<input type="checkbox"/> Box No. VIII	Certain observations on the international application

Date of submission of the demand 25 August 2005	Date of completion of this report 20 December 2005
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer JOHN DEUIS Telephone No. (02) 6283 2146

Box No. I Basis of the report

1. With regard to the **language**, this report is based on:

☒ The international application in the language in which it was filed

☐ A translation of the international application into _____, which is the language of a translation furnished for the purposes of:

☐ international search (under Rules 12.3(a) and 23.1 (b))

☐ publication of the international application (under Rule 12.4(a))

☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

☐ the international application as originally filed/furnished

☒ the description:

pages **1-27** as originally filed/furnished

pages* received by this Authority on _____ with the letter of _____

pages* received by this Authority on _____ with the letter of _____

☒ the claims:

pages as originally filed/furnished

pages* as amended (together with any statement) under Article 19

pages* **28-32** received by this Authority on **25 August 2005** with the letter of **25 August 2005**

pages* received by this Authority on _____ with the letter of _____

☒ the drawings:

pages **1/9-9/9** as originally filed/furnished

pages* received by this Authority on _____ with the letter of _____

pages* received by this Authority on _____ with the letter of _____

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages

☐ the claims, Nos.

☐ the drawings, sheets/figs

☐ the sequence listing (*specify*):

☐ any table(s) related to the sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages

☐ the claims, Nos.

☐ the drawings, sheets/figs

☐ the sequence listing (*specify*):

☐ any table(s) related to the sequence listing (*specify*):

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/AU2005/000088

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-34	YES
	Claims	NO
Inventive step (IS)	Claims 1-34	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-34	YES
	Claims	NO

2. Citations and explanations (Rule 70.7)

None of the individual documents disclose all the essential features as claimed. The claims are novel and involve an inventive step.

The claims are directed at a process for solvent extracting cobalt from a leach solution, wherein the solvent contains a carboxylic acid and an aliphatic hydroxyoxime.

The closest art found was:

Derwent Abstract Accession No. 84-109393/18, Class E31, J01, M25, ES 8401143 A,
(Schortmann P C), 16 February 1984

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A process for the separation of cobalt and/or manganese from impurity elements selected from one or more
5 of calcium and magnesium contained in a leach solution, or for separating cobalt from manganese contained in a leach solution, the process comprising the step of subjecting the leach solution to solvent extraction using an organic solution of a carboxylic acid and an aliphatic
10 hydroxyoxime.
2. The process of claim 1, wherein cobalt poisoning as a result of oxidation of cobalt(II) to cobalt(III) is avoided.
15
3. The process of claim 1 or claim 2, wherein the solvent extraction of the leach solution with the organic solution produces an organic phase and an aqueous raffinate, and wherein all of the organic phase is
20 subjected to stripping with an acid solution to strip cobalt from the organic phase.
4. The process of claim 3, wherein the stripping with the acid solution is preceded by scrubbing of the organic
25 phase.
5. The process of claim 3 or claim 4, wherein the stripping with the acid solution is preceded by a selective stripping stage.
30
6. The process of any one of claims 1 to 5, wherein the organic solution displays fast extraction kinetics for copper, cobalt, zinc and manganese.
- 35 7. The process of any one of claims 1 to 6, wherein the organic solution is in contact with the leach solution for a period of 5 minutes or less.

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8. The process of claim 7, wherein the organic solution is in contact with the leach solution for a period of 3 minutes or less.
- 5 9. The process of claim 7, wherein the organic solution is in contact with the leach solution for a period of 2 minutes or less.
- 10 10. The process of any one of claims 1 to 8, wherein the organic solution comprises a stabilizer against hydroxyoxime degradation.
- 15 11. The process of claim 10, wherein the stabilizer reduces oxidation and/or hydrolysis of the hydroxyoxime.
12. The process of claim 10, wherein the stabilizer is an antioxidant.
- 20 13. The process of claim 10, wherein the stabilizer is an alkylphenol.
14. The process of any one of claims 1 to 13, wherein the leach solution contains little nickel.
- 25 15. The process of any one of claims 1 to 14, wherein the leach solution contains cobalt and/or manganese, together with impurity elements selected from one or more of calcium, magnesium, (manganese) and chloride, optionally together with copper and/or zinc.
- 30 16. The process of any one of claims 1 to 15 wherein, the leach solution contains the following levels of elements:
- Ni: 0 - 100 ppm
- 35 Co: 100 ppm - 5 g/L
- Cu: 0 - 100 ppm
- Zn: 0.2 - 2 g/L

- 30 -

Ca: 1ppm - saturated

Mn: 0.2 - 50 g/L

Mg: 1ppm - 100 g/L

5 17. The process of any one of claims 1 to 16, wherein the
leach solution is a solution that has been subjected to a
preliminary iron and/or aluminium precipitation step to
precipitate out iron and/or aluminium to leave an aqueous
leach solution containing the target elements and impurity
10 elements.

18. The process of any one of claims 1 to 17, wherein the
carboxylic acid is 2-methyl, 2-ethyl heptanoic acid or a
cationic exchange extractant having extraction
15 characteristics similar to 2-methyl, 2-ethyl heptanoic
acid.

19. The process of any one of claims 1 to 18, wherein the
hydroxyoxime is a chelating α -hydroxyoxime.
20

20. The process of any one of claims 1 to 19, wherein the
leach solution contains cobalt and manganese, and the pH
of the aqueous phase in the solvent extraction step is
maintained in the range of from 5.5 to 7.0 to effect
25 extraction of the cobalt and manganese into the organic
phase.

21. The process of claim 20, wherein the pH of the
aqueous phase in the solvent extraction step is maintained
30 in the range of from 5.8 to 6.3.

22. The process of claim 20 or claim 21, wherein the
organic phase containing cobalt and manganese is subjected
to selective stripping to separate to a significant extent
35 the cobalt from the manganese.

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23. The process of claim 22, wherein the selective stripping comprises contacting the organic phase from the solvent extraction with an acidic aqueous solution to yield (a) a loaded strip liquor containing manganese and
5 (b) a selectively stripped organic solution containing cobalt.

24. The process of claim 23, wherein the acidic aqueous solution used in the selective stripping has a pH in the
10 range of 4.0 to 5.0.

25. The process of any one of claims 1 to 19, wherein the leach solution contains cobalt and manganese, and the pH of the aqueous phase in the solvent extraction step is
15 maintained in the range of from 3.5 to 5.0 to effect extraction of cobalt into the organic phase and rejection of manganese to the aqueous phase.

26. The process of claim 23, wherein the cobalt is
20 recovered from the organic phase by bulk stripping.

27. The process of any one of claims 1 to 26, wherein the leach solution comprises zinc and/or copper, the zinc and/or copper are extracted into the organic phase with
25 the cobalt in the solvent extraction step, and the zinc and/or copper are separated from the cobalt by ion exchange.

28. The process of any one of claims 1 to 19, wherein the
30 leach solution comprises manganese and a low level or no cobalt, and the manganese is extracted into the organic phase to effect separation of manganese from the impurity elements calcium and/or magnesium.

29. The process of any one of claims 1 to 28, wherein
35 scrubbing is conducted on the organic phase after each solvent extraction.

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30. A process for the separation of zinc, copper and cobalt from impurity elements selected from one or more of manganese, calcium and magnesium contained in a leach solution, the process comprising the step of subjecting the leach solution to solvent extraction using an organic solution of a carboxylic acid and an aliphatic hydroxyoxime.
31. The process of claim 30, wherein cobalt poisoning as a result of oxidation of cobalt(II) to cobalt(III) is avoided.
32. The process of claim 30 or claim 31, wherein the solvent extraction of the leach solution with the organic solution produces an organic phase and an aqueous raffinate, and wherein all of the organic phase is subjected to stripping with an acid solution to strip cobalt from the organic solution.
33. The process of any one of claims 30 to 31, wherein the organic solution displays fast extraction kinetics for copper, cobalt, zinc and manganese.
34. A product recovered by the process according to any one of claims 1 to 33.